

56818B~1  
SEQUENCE LISTING

<110> Washington University

<120> Regulated Attenuation of Live Vaccines to Enhance Cross-Protective Immunogenicity

<130> 56029-40434

<140> PCT/US03/11802

<141> 2003-04-15

<150> US 60/373,626

<151> 2002-04-18

<150> US 60/372,616

<151> 2002-04-15

<160> 21

<170> PatentIn version 3.1

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Ile Arg Thr Thr Ile Val Val Pro Glu Pro Ser Glu Leu Ala Glu Thr  
35 40 45

Lys Lys Lys Ala Glu Glu Ala Thr Lys Glu Ala Glu Val Ala Lys Lys  
50 55 60

Lys Ser Glu Glu Ala Ala Lys Glu Val Glu Val Glu Lys Asn Lys Ile  
65 70 75 80

Leu Glu Gln Asp Ala Glu Asn Glu Lys Lys Ile Asp Val Leu Gln Asn  
85 90 95

Lys Val Ala Asp Leu Glu Lys Gly Ile Ala Pro Tyr Gln Asn Glu Val  
100 105 110

Ala Glu Leu Asn Lys Glu Ile Ala Arg Leu Gln Ser Asp Leu Lys Asp  
115 120 125

Ala Glu Glu Asn Asn Val Glu Asp Tyr Ile Lys Glu Gly Leu Glu Gln  
130 135 140

Ala Ile Thr Asn Lys Lys Ala Glu Leu Ala Thr Thr Gln Gln Asn Ile  
145 150 155 160

Asp Lys Thr Gln Lys Asp Leu Glu Asp Ala Glu Leu Glu Leu Glu Lys  
165 170 175

Val Leu Ala Thr Leu Asp Pro Glu Gly Lys Thr Gln Asp Glu Leu Asp  
180 185 190

Lys Glu Ala Ala Glu Ala Glu Leu Asn Glu Lys Val Glu Ala Leu Gln  
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Asn Gln Val Ala Glu Leu Glu Glu Glu Leu Ser Lys Leu Glu Asp Asn  
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35 40 45

Asp Gln Lys Lys Thr Glu Glu Lys Ala Ala Leu Glu Lys Ala Ala Ser  
50 55 60

Glu Glu Met Asp Lys Ala Val Ala Ala Val Gln Gln Ala Tyr Leu Ala  
65 70 75 80

Tyr Gln Gln Ala Thr Asp Lys Ala Ala Lys Asp Ala Ala Asp Lys Met  
85 90 95

Ile Asp Glu Ala Lys Lys Arg Glu Glu Glu Ala Lys Thr Lys Phe Asn  
100 105 110

Thr Val Arg Ala Met Val Val Pro Glu Pro Glu Gln Leu Ala Glu Thr  
115 120 125

Lys Lys Lys Ser Glu Glu Ala Lys Gln Lys Ala Pro Glu Leu Thr Lys  
130 135 140

Lys Leu Glu Glu Ala Lys Ala Lys Leu Glu Glu Ala Glu Lys Lys Ala  
145 150 155 160

Thr Glu Ala Lys Gln Lys Val Asp Ala Glu Glu Val Ala Pro Gln Ala  
165 170 175

Lys Ile Ala Glu Leu Glu Asn Gln Val His Arg Leu Glu Gln Glu Leu  
180 185 190

Lys Glu Ile Asp Glu Ser Glu Ser Glu Asp Tyr Ala Lys Glu Gly Phe  
195 200 205

Arg Ala Pro Leu Gln Ser Lys Leu Asp Ala Lys Lys Ala Lys Leu Ser  
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210 215 56818B~1 220  
 Lys Leu Glu Glu Leu Ser Asp Lys Ile Asp Glu Leu Asp Ala Glu Ile  
 225 230 235 240  
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Glu

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 Lys Glu Ala Thr Gln Arg Lys Asp Glu Ala Glu Ala Ala Phe Ala Thr  
 20 25 30  
 Ile Arg Thr Thr Ile Val Val Pro Glu Pro Ser Glu Leu Ala Glu Thr  
 35 40 45  
 Lys Lys Lys Ala Glu Glu Ala Thr Lys Glu Ala Glu Val Ala Lys Lys  
 50 55 60  
 Lys Ser Glu Glu Ala Ala Lys Glu Val Glu Val Glu Lys Asn Lys Ile  
 65 70 75 80  
 Leu Glu Gln Asp Ala Glu Asn Glu Lys Lys Ile Asp Val Leu Gln Asn  
 85 90 95  
 Lys Val Ala Asp Leu Glu Lys Gly Ile Ala Pro Tyr Gln Asn Glu Val  
 100 105 110  
 Ala Glu Leu Asn Lys Glu Ile Ala Arg Leu Gln Ser Asp Leu Lys Asp  
 115 120 125  
 Ala Glu Glu Asn Asn Val Glu Asp Tyr Ile Lys Glu Gly Leu Glu Gln  
 130 135 140

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Ala Ile Thr Asn Lys Lys Ala Glu Leu Ala Thr Thr Gln Gln Asn Ile  
145 150 155 160

Asp Lys Thr Gln Lys Asp Leu Glu Asp Ala Glu Leu Glu Leu Glu Lys  
165 170 175

Val Leu Ala Thr Leu Asp Pro Glu Gly Lys Thr Gln Asp Glu Leu Asp  
180 185 190

Lys Glu Ala Ala Glu Ala Glu Leu Asn Glu Lys Val Glu Ala Leu Gln  
195 200 205

Asn Gln Val Ala Glu Leu Glu Glu Glu Leu Ser Lys Leu Glu Asp Asn  
210 215 220

Leu Lys Asp Ala Glu Thr Leu Gln Ser Pro Val Ala Ser Gln Ser Lys  
225 230 235 240

Ala Glu Lys Asp Tyr Asp Ala Ala Lys Lys Asp Ala Lys Asn Ala Lys  
245 250 255

Lys Ala Val Glu Asp Ala Gln Lys Ala Leu Asp Asp Ala Lys Ala Ala  
260 265 270

Gln Lys Lys Tyr Asp Glu Asp Gln Lys Lys Thr Glu Glu Lys Ala Ala  
275 280 285

Leu Glu Lys Ala Ala Ser Glu Glu Met Asp Lys Ala Val Ala Ala Val  
290 295 300

Gln Gln Ala Tyr Leu Ala Tyr Gln Gln Ala Thr Asp Lys Ala Ala Lys  
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Asp Ala Ala Asp Lys Met Ile Asp Glu Ala Lys Lys Arg Glu Glu Glu  
325 330 335

Ala Lys Thr Lys Phe Asn Thr Val Arg Ala Met Val Val Pro Glu Pro  
340 345 350

Glu Gln Leu Ala Glu Thr Lys Lys Lys Ser Glu Glu Ala Lys Gln Lys  
355 360 365

Ala Pro Glu Leu Thr Lys Lys Leu Glu Glu Ala Lys Ala Lys Leu Glu  
370 375 380

Glu Ala Glu Lys Lys Ala Thr Glu Ala Lys Gln Lys Val Asp Ala Glu  
385 390 395 400

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Glu Val Ala Pro Gln Ala Lys Ile Ala Glu Leu Glu Asn Gln Val His  
405 410 415

Arg Leu Glu Gln Glu Leu Lys Glu Ile Asp Glu Ser Glu Ser Glu Asp  
420 425 430

Tyr Ala Lys Glu Gly Phe Arg Ala Pro Leu Gln Ser Lys Leu Asp Ala  
435 440 445

Lys Lys Ala Lys Leu Ser Lys Leu Glu Glu Leu Ser Asp Lys Ile Asp  
450 455 460

Glu Leu Asp Ala Glu Ile Ala Lys Leu Glu Asp Gln Leu Lys Ala Ala  
465 470 475 480

Glu Glu Asn Asn Asn Val Glu  
485